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Energy Transition in South Asia: The Nexus of Institutional Quality and Financial Development

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The primary goal of this study is to determine the impact of institutional quality and financial development on the energy transition in South Asia. Using the panel Auto Regressive Distributive Lags (ARDL) estimator, the study finds a significant role for both variables in promoting the energy transition in the region. Appropriate policies should be considered to enhance a nation's institutional quality and financial development, as they directly promote the energy transition.

I. Introduction

Energy transition towards renewable energy consumption is crucial for addressing environmental issues and improving energy efficiency to reduce demand, enhance energy security, and lessen environmental damage (Jain & Goswami, 2021; Uzar, 2020). Moreover, the limited availability of modern energy is seen as a barrier to a nation's well-being and to achieving the Sustainable Development Goals (SDGs). This is further complicated by the heavy reliance on fossil fuels in South Asia. In South Asia, fossil fuels account for 80% of the region's energy production and are responsible for 63% of its greenhouse gas emissions (IEA, 2024a). In that context, transitioning to renewable energy sources, like solar and wind, has become significantly more affordable, with cost reductions of 89% and 70% over the past decade (World Energy Outlook, 2024b). Therefore, energy transition is essential for addressing climate vulnerability and ensuring sustainable regional development. While research often focuses on the role of energy transition in green growth (Narayan & Narayan, 2010), less attention is given to the factors influencing its adoption. Research on energy transition and its determinants has emerged recently, yielding mixed findings. The determinants of energy transition vary by country and are driven by multiple factors. Limited research exists on these factors, emphasizing the need for further exploration.

Researchers and policymakers have recently turned to understanding the factors that influence the adoption of energy transition worldwide. A key focus has been on institutional quality (IQ) and financial development (FD), which studies show have significant impacts on energy transition

(Saadaoui & Chtourou, 2023). Institutional factors like political constraints, environmental norms, and the quality of governance play a crucial role in determining a country's willingness to undergo energy transition (Sequeira & Santos, 2018). Stable institutions are vital for sustainable development and effective management of energy consumption (Islam et al., 2022). The quality of government institutions also affects a country's environmental standards and energy consumption patterns, either positively or negatively (Hosseini & Kaneko, 2013). According to Chang et al. (2018), institutions are instrumental in overseeing the implementation of energy-related policies, and countries with stronger institutions tend to have higher levels of renewable energy consumption. Empirical evidence consistently highlights the significant influence of institutions on a nation's adoption of renewable energy (Nawaz & Rahman, 2023). Wu & Broadstock (2015) argue that financial development is crucial for an energy transition alongside institutional quality. A well-developed financial market helps businesses manage risks and secure funds for investing in energy-efficient technology and renewable energy projects (Bekaert et al., 2005). It also facilitates the reallocation of funds from less efficient traditional energy sources to renewable energy sources (Gurley & Shaw, 1955). Studies consistently demonstrate a positive relationship between financial development and energy transition (Nawaz & Rahman, 2023).

The Energy transition is essential for preserving the environment and aligning with the SDGs. This study is situated within the framework of SDG7, which advocates for universal access to affordable and clean energy. By contextualizing the energy transition within global sustainabil-

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ity objectives, this study highlights its significance for sustainable development. Researchers stress the importance of institutions and the financial sector in driving this transition, especially in developing countries. The ability of the financial sector to support the switch towards energy transition depends on the quality of institutional frameworks. Nations with weak institutions and problems in their banking systems are more likely to face corruption and to favor traditional energy sources over renewables. The connection between financial development and institutional quality can either accelerate or hinder the adoption of renewable energy, depending on a country's institutional setup (Olaniyi et al., 2023). Reforms in the financial and institutional sectors are also considered important for boosting the demand for energy transition (Nawaz & Rahman, 2023). Accordingly, this research aims to investigate how IQ and FD influence renewable energy consumption in South Asia. Understanding these factors is crucial for developing more effective policies to promote sustainable growth, particularly in South Asia.

The paper introduces novel aspects by exploring the roles of IQ and FD in the energy transition of South Asia. The panel ARDL approach evaluates these roles in the short and long run, contributing uniquely to the existing literature. Analyzing the short- and long-run relationships among IQ, FD, and energy transition is critical for South Asia, as it provides insights for both timely policy responses and enduring structural reforms. Such temporal analysis is particularly important given the region's institutional heterogeneity and persistent developmental challenges. Furthermore, the study considers net emissions as an additional factor in determining energy transition. Overall, the paper contributes to the literature on renewable energy transition in the South Asia region by shedding light on the relationship between institutional quality, financial development, and energy transition. Additionally, it offers practical implications for policymakers, investors, and stakeholders seeking to promote renewable energy consumption, including actionable recommendations for policy reforms and investment strategies to accelerate the transition towards a more sustainable energy future in South Asia.

Using panel ARDL estimators, the study reveals that IQ and FD significantly influence the energy transition in South Asia, exhibiting distinct short- and long-term effects. Additionally, net emissions play a pivotal role in shaping the region's energy transition dynamics.

The following sections of the study are organized as follows. Section II details data sources and methodologies; Section III presents results and discussion; and Section IV concludes the study.

II. Methodology and Data

A. Methodology

The study utilizes a Panel ARDL model for its stated objective. Before applying the model, a preliminary analysis of the stationarity of the variables is performed. The panel ARDL model analyzes the short- and long-run relationships among IQ, FD, net emissions, and the energy transition of

South Asia. The empirical model of the study is explained below.

$$ET_{i,t} = \beta_0 + \beta_1 IQ_{i,t} + \beta_2 FD_{i,t} + \beta_3 NE_{i,t} + \gamma_1 IQ_{i,t-1} + \gamma_2 FD_{i,t-1} + \gamma_3 NE_{i,t-1} + \mu_i + \delta_t + \epsilon_{i,t} \quad (1)$$

In Equation (1), i denotes the cross-section unit, and t is time. The dependent variable ($ET_{i,t}$) represents energy transition, defined as the share of renewables in total energy consumption. This measure of energy transition is significantly impacted by factors such as IQ, FD, and a nation's net emissions (NE). The dependent variable is also affected by its lagged value, as explained earlier. The individual-specific and time-specific effects are captured by μ_i and δ_t , respectively. Finally, the error term is represented by $\epsilon_{i,t}$. Furthermore, the study utilized a panel ECM to evaluate the rate of adjustment in the dependent variable following a shock. A negative and significant value indicates a long-run association between the independent and dependent variables. The following outlines the ECM equation.

$$\Delta ET_{it} = \varphi_i (ET_{i,t-1} - \beta_0 X_{i,t}) + \sum_{j=1}^{p-1} a_{ij} \Delta ET_{it-j} + \sum_{j=0}^{q-1} \delta_{ij} \Delta X_{it-j} + \mu_i + \epsilon_{it} \quad (2)$$

B. Data

The study relies on annual panel data from the World Development Indicators (WDI) to achieve its objective. The WDI database was used to retrieve all the necessary data for the investigation, including 192 observations from eight South Asian nations. The dataset covers the period from 1998 to 2022.

Like many other studies, we measure energy transition by the proportion of renewable energy in a nation's total energy consumption (Kang et al., 2021). Our study specifically investigates the influence of IQ and FD on the energy transition in South Asia. IQ is assessed by averaging six indicators: corruption control, government performance, political stability and violence, regulatory quality, rule of law, and voice and accountability. FD is another significant determinant, reflecting the extent of credit provided for investment purposes to private entities. Additionally, we gather country-level net emission data from the same database. To ensure comparability in the analysis, all dependent and independent variables are transformed using natural logarithms. A comprehensive description of the variables and their respective sources is provided in [Table 1](#).

III. Results

In addition to the previously provided information, it is essential to present comprehensive summary statistics for all variables. [Table 2](#) outlines the descriptive statistics for both the dependent and independent variables. According to [Table 2](#), the average value of energy transition is 3.4637, with a standard deviation of 1.2469. Conversely, the mean values of IQ, FD, and net emissions are -0.7337, 4.2198, and -0.5055, respectively. Notably, the standard deviation of net

Table 1. Variables description

Sl. No	Variables name	Descriptions	Source
1	Energy transition	Share of renewable energy in total energy consumption	WDI
2	Institutional quality	The average of six major governance indicators	WDI
3	Financial development	Amount of credit disbursed to the private sector	WDI
4	Net emission	Total amount of emissions	WDI

Note: this table presents a detailed description of all variables.

Table 2. Descriptive statistics

Variables	Observations	Mean	Std. Dev.	Min	Max
Energy transition	192	3.4637	1.2469	-0.1953	4.5375
Institutional quality	192	-0.7337	0.8519	-5.0303	-0.2793
Financial development	192	4.2198	0.3582	3.3115	4.8653
Net emission	192	-0.5055	0.9828	-2.9028	1.3770

Note: This table reports descriptive statistics of all variables used in this study.

Table 3. Panel unit root test

Variables	I (0)	I (1)
Energy transition	-0.1932 (0.4234)	-3.1048*** (0.0010)
Institutional quality	0.0359 (0.5143)	-4.7797*** (0.0000)
Financial development	-14.0233*** (0.0000)	-30.0959*** (0.0000)
Net emission	0.8008 (0.2116)	-3.5473*** (0.0002)

Note: This table reports panel unit root test results. The null hypothesis examined is no unit root. *** represents statistical significance at the 1% level.

emissions (0.9828) is higher than the standard deviations of FD (0.3582) and IQ (0.8519).

Unit root tests are used to examine the null hypothesis of a unit root in the variables. Rejecting the null hypothesis suggests that the variables do not contain a unit root. [Table 3](#) summarizes the conclusions from these empirical tests. According to [Table 3](#), the variables under investigation show a mixed order of I(0) and I(1).

Based on the unit root test results, the study used the ARDL Pooled Mean Group (PMG) model to analyze how IQ and FD affect energy transition in South Asia. The lag length for the panel ARDL model (4,1,1,1) was selected using the Akaike Information Criterion. The empirical findings indicate that IQ positively influences energy transition in South Asia. A one percent increase in IQ corresponds to a 2.75 percent increase in energy transition. Nations with stronger institutional frameworks tend to exhibit higher levels of energy transition, consistent with findings from other studies (Saadaoui & Chtourou, 2023). Furthermore, FD plays a crucial role in promoting energy transition. Our study finds that a one percent increase in domestic credit disbursement is associated with a 3.77 percent rise in energy transition. Increased credit availability through banks and financial institutions is associated with higher adop-

Table 4. Panel ARDL analysis

Panel A: Long-Run Analysis	
Variables	Coefficient
Institutional quality	2.7589 *** (0.1604)
Financial development	3.7706 ** (1.3681)
Net emission	-0.0789 ** (0.0260)
Panel B: Short-Run Analysis	
Variables	Coefficient
ECT	-0.1230* (0.0829)
Δ Institutional quality	2.9503*** (0.5472)
Δ Financial development	-4.2281 (0.4497)
Δ Net emission	-0.0613 (0.0629)
Constant	-1.4006* (0.7598)
Log-Likelihood	923.094
Observations	167

Note: ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively.

tion of renewable energy. However, net emissions pose a challenge, with a one percent increase resulting in a 0.07 percent reduction in the energy transition. This aligns with the findings of many other studies (Olaniyi et al., 2023).

The ARDL model also examines short-run relationships, as reported in Panel B of [Table 4](#). Our empirical findings indicate that only institutional quality is significant in the short run, consistent with Rahman & Sultana (2022). Another critical feature of the ARDL model is the computation of the error-correction term (ECT) in conjunction with

short-run and long-run analyses. This approach helps assess long-run convergence based on short-run dynamics. A significantly negative ECT provides evidence of long-run convergence among energy transition, IQ, FD, and net emissions.

IV. Conclusion

Analyzing factors influencing energy transition is key to academic research and global policy, particularly in economies like South Asia. Investigating the roles of IQ and FD in energy transition is crucial amid rising environmental challenges. Understanding the influence of these variables can lead to increased acceptance of renewable energy among the public. An empirical study was conducted to investigate the significance of IQ and FD for energy transition in the South Asian region. Using an ARDL model, the study demonstrates the importance of IQ for energy transition in both the short and long run. In the long run, a positive association between FD and energy transition was found. Finally, the analysis provides evidence that all variables converge in the long run.

Analyzing the impact of IQ and FD on renewable energy in the South Asia region is crucial. It informs policymakers about the need for strong institutional frameworks to support energy transition. Enhancing the rule of law and regulatory frameworks is fundamental to strengthening institutional quality. These mechanisms foster transparency, accountability, and effective governance, thereby supporting sustainable development through energy transition. Furthermore, enhanced FD facilitates the allocation of capital by investors toward renewable energy initiatives in conducive environments, thereby promoting increased funding and accelerating the energy transition process. It also enables effective risk management, technology transfer, and the promotion of innovation in renewable energy technologies. Recognizing the pivotal roles of IQ and FD, stringent policy measures are necessary, including stable political frameworks, improved access to credit, and robust regulatory actions against polluters to encourage the widespread adoption of renewable energy.

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References

- Bekaert, G., Harvey, C. R., & Lundblad, C. (2005). Does financial liberalization spur growth? *Journal of Financial Economics*, 77(1), 3–55. <https://doi.org/10.1016/j.jfineco.2004.05.007>
- Chang, C. P., Wen, J., Zheng, M., Dong, M., & Hao, Y. (2018). Is higher government efficiency conducive to improving energy use efficiency? Evidence from OECD countries. *Economic Modelling*, 72, 65–77. <https://doi.org/10.1016/j.econmod.2018.01.006>
- Gurley, J. G., & Shaw, E. S. (1955). Financial aspects of economic development. *The American Economic Review*, 45(4), 515–538.
- Hosseini, H. M., & Kaneko, S. (2013). Can environmental quality spread through institutions? *Energy Policy*, 56, 312–321. <https://doi.org/10.1016/j.enpol.2012.12.067>
- International Energy Agency. (2024a). *Energy Technology Perspectives*. IEA.
- International Energy Agency. (2024b). *World Energy Outlook 2024*. IEA.
- Islam, M. M., Ali, M. I., Ceh, B., Singh, S., Khan, M. K., & Dagar, V. (2022). Renewable and non-renewable energy consumption driven sustainable development in ASEAN countries: do financial development and institutional quality matter? *Environmental Science and Pollution Research*, 29(23), 34231–34247. <https://doi.org/10.1007/s11356-021-18488-x>
- Jain, P., & Goswami, B. (2021). Energy efficiency in South Asia: Trends and determinants. *Energy*, 221, 119762. <https://doi.org/10.1016/j.energy.2021.119762>
- Kang, X., Khan, F. U., Ullah, R., Arif, M., Rehman, S. U., & Ullah, F. (2021). Does foreign direct investment influence renewable energy consumption? empirical evidence from south Asian countries. *Energies*, 14(12), 3470. <https://doi.org/10.3390/en14123470>
- Narayan, P. K., & Narayan, S. (2010). Carbon dioxide emissions and economic growth: Panel data evidence from developing countries. *Energy Policy*, 38(1), 661–666. <https://doi.org/10.1016/j.enpol.2009.09.005>
- Nawaz, A., & Rahman, M. M. (2023). Renewable energy consumption in Sub-Saharan Africa: The role of human capital, foreign direct investment, financial development, and institutional quality. *Energy Reports*, 10, 3383–3393. <https://doi.org/10.1016/j.egy.2023.10.025>
- Olaniyi, C. O., Al-Faryan, M. A. S., & Ogbaro, E. O. (2023). Do institutional quality and its threshold matter in the sensitivity of the renewable energy transition to financial development? New empirical perspectives. *International Journal of Finance & Economics*.
- Rahman, M. M., & Sultana, N. (2022). Impacts of institutional quality, economic growth, and exports on renewable energy: Emerging countries perspective. *Renewable Energy*, 189, 938–951. <https://doi.org/10.1016/j.renene.2022.03.034>
- Saadaoui, H., & Chtourou, N. (2023). Do institutional quality, financial development, and economic growth improve renewable energy transition? Some Evidence from Tunisia. *Journal of the Knowledge Economy*, 14(3), 2927–2958. <https://doi.org/10.1007/s13132-022-00999-8>
- Sequeira, T. N., & Santos, M. S. (2018). Renewable energy and politics: A systematic review and new evidence. *Journal of Cleaner Production*, 192, 553–568. <https://doi.org/10.1016/j.jclepro.2018.04.190>
- Uzar, U. (2020). Political economy of renewable energy: does institutional quality make a difference in renewable energy consumption? *Renewable Energy*, 155, 591–603. <https://doi.org/10.1016/j.renene.2020.03.172>
- Wu, L., & Broadstock, D. C. (2015). Does economic, financial and institutional development matter for renewable energy consumption? Evidence from emerging economies. *International Journal of Economic Policy in Emerging Economies*, 8(1), 20–39. <https://doi.org/10.1504/IJEPEE.2015.068246>